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Contemplating Military Innovation

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PREFACE

This document, prepared under IDA's Central Research Program, briefly describes the concepts behind and components of military innovation. While military innovation represents a broad and complex subject matter, this document is meant to provide the reader with a general overview of the subject, the forces that influence it, and the process.

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EXECUTIVE SUMMARY

Given the current and anticipated strategic environment and the rapid pace of technological advance, military innovation has become an important topic both within and outside the Beltway. Its importance cannot be understated; the choices that are made today will directly affect the ability of the U.S. military to successfully complete the missions and tasks they are given in the future. The current debate, however, seems to be characterized by dissatisfaction and frustration, two emotions that complicate an inherently complex topic.

While decision-makers call for "leap-ahead capabilities" [Coats 1997], the fact of the matter is that *innovation*, as "[s]omething newly introduced" [Houghton 1996, p. 931], implies no sense of radical improvement or change. If the efforts of the U.S. military are judged using this definition, then they have been innovating for quite some time. If however, we attempt to identify the intent of the decision-makers discussing military innovation, it becomes apparent that they are looking for the innovations that will transform the U.S. military; they are looking for the innovations that will enable them to perform a broader range of missions more effectively and at a lower cost. This type of language is typical of the study of Revolutions in Military Affairs (RMAs), of which innovation is only a part. By equating military innovation with a revolution in military affairs, we give undue importance to the former while diminishing the significance of the latter.

The very nature of military innovation makes it a complicated affair. While some authors have assumed that "...[military] innovation is natural and the result of a dynamic environment in which organizations must accept change if they are to survive. [Murray and Millett 1996, p. 5]", quite the opposite seems to be true. Military institutions, because of their bureaucratic nature, are "...especially resistant to change [Rosen 1991, p.2]." If this view is correct, then the identification and characterization of the forces that motivate (or impede) innovation becomes important to the decision-maker. Understanding these forces allows the decision-maker a better understanding of the politics of innovation. A review of recent works on military innovation seems to indicate that the existence of a coherent and well-developed grand strategy, thorough assessments of the strategic environment, the willingness of an institution to consider innovative concepts (its institutional culture), the amount and type of civilian participation, the military's access to technology, and the availability of financial resources are all important forces that influence military innovation.

While those involved with military innovation are concerned with identifying and developing the concepts and technologies that will allow the U.S. military to maintain its battlefield preeminence, the study of history provides us with useful models for understanding innovation as the process. The widely hailed *Reichswehr* and their development of armored warfare during the Interwar Period demonstrated the importance of evaluating prior experiences, institutional flexibility (the willingness to experiment with new ideas), practical experimentation with innovative concepts (for example, the German's use of mock tanks in field exercises and their observation and examination of foreign field

exercises involving tanks), and the refinement of doctrine even after its implementation. Failure to thoroughly experiment with and evaluate new concepts and technologies can result in the misallocation of funds or the development of a false sense of security, as was the case with the British development of asdic.

It is often difficult to articulate what is hoped for in any discussion of military innovation. Discerning between the plausible, the possible, and the impossible is difficult when one considers the rapid advances that the scientific community is making. Decision-makers can clarify their hopes and goals by attempting to describe innovation in explicit terms. *Evolutionary* and *revolutionary* seem to describe the degree of change (incremental versus radical) while *tactical*, *operational*, and *strategic* allow for the placement of a particular innovation within a specific context. By using these words, or words like these, to describe innovation, decision-makers might be able to dispel some of the ambiguity that prevents the effective communication of their ideas.

Military innovation is critical to the future prosperity of this nation. The choices that are made today will affect the next generation of Americans. The relative peace of the current strategic environment provides America with a chance to explore and develop military technologies that has not been experienced since the period of time between the two World Wars. Failure to exploit this time could well have consequences for not only our national security, but our national sovereignty.

Chapter 1. Introduction

Changes in the geopolitical environment and the rapid pace of technological advances have pushed the topic of military innovation to the top of political and military debates. Whether one reads congressional speeches or military vision statements, many people identify innovation as a key component of future U.S. military strength and success. However, the current debate about military innovation seems to be plagued by a reliance on intuitive definitions—definitions that make meaningful debate difficult due to their personal nature. Perhaps more significantly, while various forms of the word *innovate* are used, the real topic of the debate seems to be focused on trying to identify the best way for the U.S. military to increase its capabilities; to be able to carry out more types of missions more effectively and at a lower cost. Military innovation, as an approach to increasing capabilities, is a complicated subject. There are several questions concerning the very nature of military innovation, the forces that influence military innovations, the best way to accomplish military innovation, and the inherently risky nature of military innovation in times of strategic (or geopolitical) uncertainty.

Intuitive definitions, being affected by personal perceptions and experiences, drastically alter the meaning of words like *innovate*, *innovative*, and *innovation*. The lack of a standard definition (or, perhaps more appropriately, the failure to use the standard definition) results in the miscommunication and misinterpretation of ideas. This miscommunication is typically a source of frustration for all parties involved in the decision making process. An innovation is “[s]omething newly introduced” [Houghton 1996, p. 931] and the word’s definition carries no sense of magnitude (e.g., evolutionary or revolutionary) or improvement (*new* is not necessarily *better*). The common practice of intuitively linking a degree of magnitude or sense of improvement to innovation complicates and clouds most discussions.

There are several approaches for decision-makers to consider and the development and use of new (and improved) concepts, systems, and technologies certainly plays an important role in any effort at enhancing military capabilities. By acknowledging that military innovation is one approach to improving military capabilities, we can also draw on some thoughts and conclusions made by those who have contemplated and studied Revolutions in Military Affairs (RMAs) and their impact on military institutions. In fact, the current debate about military innovation might be better described as a continuance of the debate about RMAs.

Before we can discuss military innovation in terms of process or product, we ought to consider its very nature. Why do military institutions innovate? What forces influence

military innovation? Answering these questions will provide some insight into the origins, nature, and extent of military innovation.

Once it is demonstrated that the current debate is really about improving military effectiveness, we can look at military innovation as a process. How do military institutions, which have been described by some as "...especially resistant to change" [Rosen 1991, p. 2], innovate? History provides us with several examples of military institutions that have been successful at military innovation and others that were unsuccessful. These historical examples can assist modern decision-makers in assessing the institutional processes currently in place and can be used as models for suggesting any necessary changes.

Perhaps the most difficult aspect of military innovation is describing it. The involved parties will talk of "leap-ahead capabilities" [Coats 1997], "new capabilities" [Van Riper 1998, p. 55], and "innovative means" [Reimer 1998, p. 20] without defining their objectives in terms that are easily understood by others. The ambiguity of these phrases can contribute to the miscommunication between the involved parties. A pebble and a boulder are both stones separated only by their magnitude. Bringing one when the other was desired can result in feelings of frustration on the part of both the one who makes the request and the one who attempts to fulfill it. The current debates about military innovation usually lack a sense of specificity. In describing military innovation, one ought to consider both the magnitude of the innovation (how important is the innovation) in a given context as well as type of innovation (*evolutionary* versus *revolutionary*). By describing and viewing military innovations in this way, decision-makers might be better able to understand their counterpart's point of view and engage them in more meaningful (and specific) discussion of military innovation.

Military innovation is a decidedly complicated topic. An incomplete understanding of its various facets further complicates it. This paper is meant to provide the reader with some insight into those facets so that future discussions about military innovation can be more focused and thus more meaningful.

Chapter 2. Innovation: What does it Mean and What are We Really Talking About?

The current debate about military innovation is complicated by the involved parties' inability to communicate effectively with one another. The source of this problem seems to be a reliance on intuitive, as opposed to standard or universal, definitions for *innovate*, *innovative*, and *innovation*. If decision-makers continue to use intuitive definitions in the debate about military innovation, they should not assume that their ideas, as they envision them, are completely understood by other parties. While effective communication is important in this debate, it is equally important to understand the overarching concept involved: military innovation, as it is discussed today, is not about introducing something new simply because it is new; it is about finding and developing the new ideas that will allow the U.S. military to carry out its mission more effectively. With that in mind, the current debate may be a continuation of the debate about revolutions in military affairs (RMAs).

2.1. WHAT WE SAY: THE MISUSE OF INNOVATE, INNOVATIVE, AND INNOVATION

While most decision-makers have an intuitive definition for each word, these intuitive definitions, being influenced by personal perception and beliefs, make meaningful conversation about innovation difficult. The personal nature of these definitions typically prevents parties (other than the speaker) from understanding the subtleties of the idea being expressed. The inability to talk about the various facets of military innovation in an easily understood and universal language can lead to feelings of frustration between the parties. Frustration that can make the military innovation, as both a process and product, more difficult than it has to be.

According to *American Heritage Dictionary of the English Language*, innovate means "[t]o begin or introduce (something new) for or as if for the first time." [Houghton 1996, p. 931] Innovation refers to either the "...act of introducing something new" or "[s]omething newly introduced" [Houghton 1996, p. 931]. Note that these definitions are simple and free of association with any other concepts. The following two paragraphs demonstrate the effects of associating additional concepts with the simple universal definitions.

Stephen P. Rosen, author of *Winning the Next War: Innovation and the Modern Military*, believes that "[c]hanges in the formal doctrine of a military organization that leave the essential workings of that organization unaltered do not count as an innovation..." [Rosen 1991, p. 8]. The dictionary's definition would not mandate such a stringent requirement for an innovation. *New* does not (and should not necessarily) mean *significant*

or *radical*. By associating *new* with *significant* or *radical*, one falls victim to the use of the intuitive definitions that are the source of misunderstandings and misperceptions. With the dictionary's definition in mind, it can truthfully be said the US military has been innovating for quite some time.

Another example of associating additional concepts with the simple universal definitions can be seen in a quote of General Dennis J. Reimer, the U.S. Army's Chief of Staff. He wrote, "...we must prepare joint forces to conduct traditional and new missions with innovative means." [Reimer 1998, p. 20] *Innovative*, according to the dictionary, does not imply that the idea is *better*; it simply states the idea is *new*. The association of *better* with *innovative* is another example of the prevalence of intuitive definitions and the effect they can have upon discussions about military innovation.

The universal definitions for the various forms of the word *innovate* are simple and free of association with other words that imply a sense of magnitude or improvement. The use of intuitive definitions, as opposed to the universal definitions, is a fundamental problem in the current debates. The parties are using the same word to describe individual ideas. In doing so, they talk past one another. This failure to communicate effectively can result in feelings of frustration that make military innovation, as both a process and product, more difficult than it already is.

2.2. THE CURRENT DEBATE: WHAT ARE WE REALLY TALKING ABOUT?

If those involved in the current debate about military innovation are, through their use of intuitive definitions, looking for something more than the "...act of introducing something new" [Houghton 1996, p. 931] we ought to attempt to identify what the true subject of the debate is. Once the true subject of the debate has been identified, the content and structure of the debate ought to change to better focus on the subject. A review of several recent publications and speeches makes it clear that the discussions about military innovation are really about the conceptualization, development, and introduction of doctrine, systems, and technologies that improve military capabilities.

Throughout speeches and publications, one reads of "leap-ahead capabilities" [Coats 1997], "innovative means" [Reimer 1998], and "new capabilities" [Van Riper 1998]. When one reads between the lines, it becomes apparent that the discussion is not so much about the "...act of introducing something new" [Houghton 1996, p. 931] as it is about the conceptualization, development, and introduction of doctrine, systems, and technologies that *improve* military capabilities. If the topic of the debate is really about how we can (or ought to) improve military capabilities, the content and structure of our debates ought to change accordingly.

Military capabilities can be improved by utilizing any one of several approaches. Consider military capabilities as the following simple equation:

$$(\text{military assets}) \times (\text{military doctrine}) = (\text{military capabilities})$$

Based on this logic, military capabilities can be enhanced through one of several methods. The military assets can be improved or can be replaced with new systems or technologies that have been proven to be more effective. Likewise, military doctrine can be improved or replaced with a new doctrine that has been proven to be more effective. Ultimately, the most dramatic improvement over current military capabilities is accomplished when new assets that have been proven to be more effective than existing systems and technologies are coupled with new doctrine that has been proven to be more effective than existing doctrine. That notion can be expressed in the following equation:

$$(\text{new military assets}) \times (\text{new military doctrine}) \gg (\text{current military capabilities})$$

2.3. THE REVOLUTION IN MILITARY AFFAIRS AND MILITARY INNOVATION: SOME THOUGHTS

While military innovation has only recently become a buzzword in U.S. politico-military circles, terms like *Military Technical Revolution* (MTR) and *Revolution in Military Affairs* (RMA) were introduced by the Soviets in the 1970s and the 1980s [Metz and Kievit 1995, p. 2]. The earlier of the two terms, *Military Technical Revolution*, was deemed inadequate because of its failure to capture the “holistic” nature of a *Revolution in Military Affairs* [Cooper 1994, p. 40; Metz and Kievit 1995, pp. 2-3].¹ The RMA was thought to be composed of four elements: operational innovation, organization adaptation, evolving military systems, and emerging technologies [Cooper 1994, p. 19]. Any one of those four elements can be a product of the process of military innovation.

RMAs have been described as

- “...a holistic effect provided by the integrating framework of doctrine and organization coupled with the enabling capabilities (e.g., information dominance, C²) and the executing capabilities (e.g., smart weapons, major platforms) provided by technology.” [Jablonsky 1994, p. 7]
- “...the product of a broad social and political transformation which gives rise to new military organizations and technologies.” It is these changes that “...demand substantial reforms in existing methods of conducting warfare.” [Mazarr 1994, p. 2]
- “...more than just new military technologies or systems and involve complex operational and organizational issues...” [Cooper 1994, p. 1]²

¹ Cooper notes that “...MTR denotes too great an emphasis on *technology* [emphasis in original]. Therefore, much of the interested community...uses the term *Revolution in Military Affairs*, which focuses on *revolution* [emphasis in original], and clearly places *technology* [emphasis in original] in a supporting role.” [Cooper 1994, P. 40]

² It should be noted that Cooper also notes in his introduction that “...there is no agreement concerning the character of this RMA—i.e., a specific definition of this RMA, not merely identification of constituent technical elements; and, therefore, there is no substantive roadmap for proceeding. Indeed, reviewing the current literature and debates, it appears that there may be several different RMAs that are being discussed (not unlike the parable of the blind men and the elephant).” [Cooper 1994, p. 1]

- “...the application of new technologies into a significant number of military systems combine[d] with innovative operational concepts and organizational adaptations in a way that fundamentally alters the character and conduct of conflict.” [Krepinevich 1994, p. 30]³

So, bearing these definitions in mind, it might be that we are still wrestling with the idea of a RMA. Military innovations, be they doctrinal or technological, are simply pieces of a larger, overarching concept: increasing military effectiveness (or achieving an RMA).

³Krepinevich's definition is remarkable because he continues by writing that “[i]t does so by producing a dramatic increase—often an order of magnitude or greater—in the combat potential and military effectiveness of armed forces.” [Krepinevich 1994, p. 30] As has been stated earlier, it is this very sense that increasing military effectiveness is the real topic of the debate and military innovations are, in fact, simply components of that goal.

Chapter 3. The Nature of Military Innovation

Having established that innovation, as the "...act of introducing something new" [Houghton 1996, p. 931], represents a fairly simple concept, why should the current debates about military innovation have become so complicated? In an effort to gain insight into the complexity of military innovation, let us consider the nature of military innovation. Why do military institutions innovate? Some assume that it is a natural occurrence while others argue that it requires external stimuli. If military innovation does not occur naturally, and requires external stimuli, what might those forces be? Do those external forces only affect military innovation in a positive manner or can those very same forces impede innovation? This section hopes to provide the reader with possible answers to those questions.

3.1. WHY DOES MILITARY INNOVATION OCCUR?

Before we can discuss military innovation as a process, we ought to consider it as a concept. Why do military institutions innovate? Murray and Millett, in the introduction to *Military Innovation in the Interwar Period*, avoid this question altogether by assuming that "...innovation is natural and the result of a dynamic environment in which organizations must accept change if they are to survive." [Murray and Millett 1996, p. 5] Despite this assertion, Murray later writes that "[r]igidity is undoubtedly a fact of life in many military organizations – one which has exercised a consistent and baleful influence over institutional capacity to innovate" [Murray 1996b, p. 322] and Millett, in a more conciliatory tone, notes that "...the military politics of innovation...both [advance] and [retard] reform." [Millett 1996, p. 349] Such statements indicate that military innovation is not natural and is, in fact, resisted by the very military institutions that would benefit from it.

If we define *natural* as being free of external influences, then the preceding quotes would indicate that military innovation is not a natural process. All the authors seem to feel that institutional rigidity (or perhaps, the influence can be better described as institutional culture) plays a role in the process of military innovation. If this is in fact the case, we ought to examine other possible forces that affect military innovation. Such a study might provide us with a better understanding of the complex nature of military innovation.

3.2. WHAT FORCES INFLUENCE MILITARY INNOVATION?

If military innovation is influenced by external factors, the identification and consideration of these factors becomes very important. These factors will allow us to gain a better understanding of why military innovation occurs (or fails to occur). Once these factors are identified and examined, it will allow the decision-maker to understand possible sources of bias against or resistance to innovative concepts and technologies.

3.2.1. EXISTENCE OF A COHERENT AND WELL-DEVELOPED GRAND STRATEGY

Although the concept of grand strategy is a very important part of military innovation, it is too complicated to discuss in great detail within the scope of this paper. Barry R. Posen, author of *The Sources of Military Doctrine*, defines grand strategy as "...a political-military, means-end chain, a state's theory about how it can best 'cause' security for itself." [Posen 1984, p. 13] Posen continues by asserting that a grand strategy must "...identify likely threats to the state's security and it must devise political, economic, military, and other remedies for those threats." [Posen 1984, p. 13] One of the difficulties inherent to the development of a grand strategy is the fact that "[p]riorities must be established among both threats and remedies...because ...the number of threats is great, and...resources are scarce." [Posen 1984, p. 13]

By defining a grand strategy, a nation provides its military (one of the "remedies" for the threat posed to the state) with a framework for organizational development and equipment. When we talk of organization development and equipment, we are talking about doctrine.⁴ Posen feels that military doctrine is the "...subcomponent of grand strategy that deals explicitly with military means." [Posen 1984, p. 13] Posen continues by writing that in any discussion of military means, two questions become important: 1.) what means shall be employed? and 2.) how shall they be employed? [Posen 1984, p. 13]

Since the *what* seems to a subcomponent of the *how*, let us consider the *how* first. Posen feels that a nation can adopt one of three different military doctrines: offensive, defensive, or deterrent [Posen 1984, pp. 14-15]. These doctrines may be defined as follows:

- *Offensive Military Doctrine.* An offensive military doctrine is characterized by an intent to disarm or destroy the military capabilities of an adversary [Posen 1984, p. 14]. Posen cites the German use of tanks, motorized infantry, and combat aircraft (commonly referred to as Blitzkrieg) as an example of such a doctrine [Posen, 1984, p. 14].
- *Defensive Military Doctrine.* A defensive military doctrine is characterized by the intent to deny an adversary the realization of their objectives. Posen uses the Maginot Line of interwar France as an example of such a doctrine [Posen 1984, p. 15].
- *Deterrent Military Doctrine.* A deterrent military doctrine is characterized by the intent to punish an aggressor or, in the words of Posen, "...to raise his costs without reference to reducing one's own." [Posen 1984, p. 14] Posen uses the military doctrine of modern Switzerland as an example of this type of doctrine [Posen 1984, p. 15].

⁴ Consider the Department of Defense definition for doctrine: "Fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives." [DOD 1998]

Once the military doctrine of a nation has been defined, the military may begin to establish what means are necessary to accomplish the ends of the state.

In this era of rapid technological advances the *what* has become a very important (and often expensive) question. The *what* seems to encompass military force structure, organization, and equipment. It ought to be directly related to the *how* but it also must take into account the perceived threats to the state and the “scarce” resources of the state. In terms of force structure, the *what* would seem to indicate the number and type of divisions and air wings,⁵ their command structure, and their staffing. In terms of equipment, the *what* would seem to indicate the quantity and type of weapon systems to be used by the force. It is when the *what* does not complement the *how* that problems can occur. If the military institutions of a state organize themselves in such a way that is not compatible with the chosen military doctrine of the state, they may limit the strategic options available to the governmental leadership in times of escalating tensions or open conflict.⁶

A nation may subscribe to different military doctrines at different times thus requiring a flexible force structure. Consider the United States, while our declared policy is that the U.S. military meet and defeat “...any adversary at any level of conflict” [JCS 1996, p. 4], the fact of the matter is that the military might need to assume a defensive posture before going on the offensive.⁷ This requires that the U.S. military develop and acquire weapons capable of both offensive and defensive applications. Likewise, military operations other than war (MOOTW) might require a different kind of *what*—non-lethal weapons, for example. Changes in a national grand strategy are typically the product of a change in the strategic (or geopolitical) environment, the second force that will be discussed.

3.2.2. A THOROUGH ASSESSMENT OF THE STRATEGIC ENVIRONMENT

Having established that a coherent and well-defined grand strategy is an important part of military innovation, let us consider a closely related matter, the strategic (or geopolitical) environment. In a reading of the works on military innovation, one of the key factors in successful military innovations is a thorough and honest assessment of the strategic environment. While each of the authors cited uses a different term for this concept, the underlying belief remains the same. The identification of and the collection of information about potential adversaries, their method of warfare, and the conditions under which combat operations might be conducted allows military institutions to develop the innovative concepts and technologies needed to counter any aggressive (or undesirable) actions taken by these adversaries.

⁵ Or for naval units, the number and type of ships found in battle groups.

⁶ Although, I would imagine the opposite could be argued as well—by organizing themselves in a manner contrary to the chosen doctrine of the state, they might, in some circumstances, provide the leadership with strategic choices that would have otherwise been unavailable.

⁷ Our most recent large conflict, Desert Shield/Desert Storm, followed this model.

Williamson Murray, in *Military Innovation in the Interwar Period*, uses the term *specificity* to describe this factor. In Murray's opinion, specificity refers to the "...presence of specific military problems the solution of which offered significant advantages to furthering the achievement of national strategy." [Murray 1996b, p. 312] Allan R. Millett, in the same work, uses the term *strategic calculations*. He feels that strategic calculations are composed of several different aspects including "...the anticipated enemy, anticipated theaters of operations, the immediacy in distance and time from the possible outbreak of war, the balance between deterring war or simply preparing to fight it, the likely length of a potential conflict, [and] the role of allies..."[Millett 1996, p. 336] Perception, strategic intention, and political intervention each play a part in strategic calculations. [Millett 1996, pp. 336-337]

Stephen P. Rosen, in *Winning the Next War: Innovation and the Modern Military*, put forth some ideas that are contrary to the assertions made by Murray and Millett. Rose noted that intelligence "...has only been loosely connected to American military innovation" [Rosen 1991, p. 254] since "[e]nemy plans and capabilities can be volatile and thus cannot provide the basis for innovations that takes years, if not decades, to bring to fruition." [Rosen 1991, p. 253] Rosen continued to explain that

...innovations in the American military have in practice been more closely linked to analyses of the anticipated security environment, which is determined by economic, technological, and political factors largely outside the control of either the United States or its potential adversaries. [Rosen 1991, p. 254]

It would appear that there is common agreement that an assessment of the strategic (or geopolitical) environment is an important factor in military innovation. The United States government, through their publication of the *National Security Strategy* and *National Military Strategy*, implicitly recognizes this fact. However, the Federal Government's current efforts at assessing the strategic environment are hampered by the high degree of uncertainty that exists in today's geopolitical arena.⁸

Strategic uncertainty is not a reason to decrease or defer efforts at military innovation. By deferring efforts at military innovation to a point at which a likely adversary emerges may result in innovations that cannot be implemented in time for a conflict with that adversary. Innovation can be pursued, even in times of great uncertainty. Rosen offered two different approaches that allow for military innovation while mitigating the effects of strategic uncertainty. The first approach, commonly known as Type I flexibility [Rosen 1991, p. 244], was described as

⁸ Consider the following statements taken from recent government publications: "Accelerating rates of change will make the future environment more unpredictable and less stable, presenting our Armed Forces with a wide range of plausible futures." [JCS 1996, p. 8]; "The security environment in which we live is dynamic and uncertain, replete with numerous challenges." [NSS 1997]; and "The 1997 National Military Strategy....states that as we pursue shaping and responding activities, we must also take steps to Prepare Now for an uncertain future." [NMS 1997]

A strategy for military technological innovation that seeks as much flexibility as it can buy might be better than one of trying to buy the one weapon that would perform the best if it could be built to specifications at the expected cost and if it eventually turned out to be the weapon which was actually needed. [Rosen 1991, pp. 243-244]

The eleven variants of the High Mobility Multipurpose Wheeled Vehicle (commonly known as the Humvee) would be a good example of Type I flexibility. Since the inclusion of capabilities that may only be used on rare occasions may inflate the costs of such a weapon system, Rosen acknowledged that this approach may, at times, be "...prohibitively expensive" [Rosen 1991, p. 244].

The second approach described by Rosen, commonly known as Type II flexibility [Rosen 1991, p. 244], to mitigate the effects of strategic uncertainty entails the development of "...many different technologies to the point of procurement, but then deferring large-scale production while other uncertainties resolved themselves." [Rosen 1991, p. 250] This approach allows for the exploration of several (and possibly competing) innovative systems or technologies without being obliged to a large scale production of a particular one. The U.S. Army Air Corps' assessment of several types of fighter aircraft during the Interwar Period without a large scale production commitment to any particular one is an example of Type II flexibility. This type of flexibility allows decision-makers to possess options not typically available to them under the current Department of Defense acquisition process that stresses commitment to a singular platform (perhaps with some slight variations).

In closing, a thorough and honest assessment of the strategic environment is an important factor in military innovation. While geopolitical uncertainty certainly complicates efforts at military innovation, it can be mitigated and should not be used as an excuse to avoid exploring the concepts and technologies that might improve U.S. military capabilities.

3.2.3. INSTITUTIONAL CULTURE

Institutional culture is another factor that seems to have a significant role to play in military innovation. Each military institution seems to develop its own culture based upon its traditional values, collective experiences, and perceived identity. For a military institution to innovate successfully, it must be willing to explore new ideas without bias or prejudice and examine and learn from prior experiences. Its culture can either facilitate or impede this process. The definition of institutional culture, as proposed by various academics, shall be discussed. It shall also be examined in terms of its bureaucratic nature. Finally, we will examine the effect institutional culture has on military innovation as both a process and a product.

As was the case with strategic assessment, the experts use several different terms to describe the underlying concept of *institutional culture*. Williamson Murray used the phrase *military culture* to describe the "...sum of the intellectual, professional, and

traditional values of an officer corps.” [Murray 1996b, pp. 312-313] Murray wrote that the significance of military culture is that it “...plays a central role in how that officer corps assesses the external environment and how it analyzes the possible response that it might make to ‘the threat.’” [Murray 1996b, p. 313] Allan R. Millett used the phrase *organizational politics* to describe the “...interservice and intraservice struggles...” [Millett 1996, p. 349] present in military institutions. Organizational politics are not, according to Millett, unchangeable since the educational development of the officer corps and the doctrinal writings of an institution have a significant impact on them [Millett 1996, p. 349]. The basis of such an argument seems to be that the educational development and officers and doctrinal writings serve a vital function in the perception and self-identification of a military institution [Millett 1996, p. 349]. This model of institutional culture also applies to subunits of an organization. Stephen P. Rosen wrote

Each branch has its own culture and distinct way of thinking about the way war should be conducted, not only by its own branch, but also by the other branches and services with which it would have to interact in combat. If the military organization is healthy, there is some general agreement among the various branches about how they should work together in wartime. This agreement is a dynamic condition. There is no permanent norm defining the dominant professional activity of the organization.

An institutional culture, in short, represents the traditional values, collective experience, and perceived identity of a service or subservice (or branch).

One of the aspects of institutional culture that influences efforts at military innovation is the bureaucratic nature of most military organizations. Rosen believes that this simple fact creates a significant impediment for military innovation. Rosen writes

Almost everything we know in theory about large bureaucracies suggests not only that they are hard to change, but that they are designed not to change....[T]he essence of a bureaucracy was routine, repetitive, orderly action. Bureaucracies were not supposed to innovate, by their very nature. Military bureaucracies, moreover, are especially resistant to change. [Rosen 1991, p. 2]

Andrew Marshall, Director of Net Assessment in the Office of the Under Secretary of Defense for Policy, seemed to concur with Rosen’s assertion. He was quoted as saying,

Changing big organizations is hard. And the military has the extra difficulty in that it's preparing to do something it doesn't have a lot of good feedback on, because it doesn't do its major task frequently. There's not a bottom line every day. [Schwartz 1995]

Because military institutions are bureaucratic, innovation, as the “act of introducing something new” [Houghton 1996, p. 311], is bound to be difficult for them. Rosen explained this point further by writing

The order to innovate is likely to be ambiguous because what is being ordered is not some familiar, well-defined task, but something that has never been done before. Those being ordered to innovate may well not have control over everything needed to carry out the order, particularly if what is needed is unconventional creativity. [Rosen 1991, pp. 10-11]

The difficulty for the modern decision-maker is learning how to change in this regard. While there has been much talk about institutionalizing innovation, one should consider the sentiment expressed by Williamson Murray:

Courses on innovation, or offices of innovation, or even the creation of innovation specialties within the services will only draw individuals interested in a safe "career" niche, rather than the driving, imaginative crusaders for innovation. If anything, such efforts to institutionalize innovation will inhibit rather than foster the process....The bureaucratization of innovation – particularly in the current framework of the U.S. military – guarantees its death. [Murray 1996b, p. 326]

Having defined institutional culture and examined its bureaucratic nature, let us examine some of the other ways it influences efforts at military innovation. Tradition, one of the cohesive forces present in almost every military organization, can act as a force against innovation in that those who strictly adhere to the traditional methods or types of warfare may be unwilling to consider new methods or types. Williamson Murray noted that "[r]arely, if ever, do military organizations receive the opportunity to innovate with a clear slate. The past weighs in with a leaden hand of tradition that can often block innovation." [Murray 1996b, p. 313] Murray felt this reluctance to innovate can be explained by the fact that "[t]he approaches that succeeded on earlier battlefields were often worked out at a considerable cost in blood." [Murray 1996b, p. 313] Rosen expresses a similar notion, when he writes

Although simulations of how future wars might be fought are possible and useful in initiating and refining innovations, certain knowledge of how a war will be fought and which new weapons or concepts of operations will be effective is not possible. For this reason, a conclusive case for or against innovation is hard to make in peacetime. [Rosen 1991, p. 109]

However, an institution's adherence to traditional methods or types of warfare will change over time. The key word here seems to be time. Rosen writes that

Senior military officers who were well respected by traditional military standards have worked to create a new set of operation tasks relevant to the new military capability and a new promotion pathway for young officers to follow as they developed those new skills. Because of the time necessary for young officers to be promoted to senior rank, the practical side of innovation typically took a generation to accomplish.... [Rosen 1991, p. 58]

This sentiment that change takes time⁹ and begins with the development of new officers was echoed by Susan L. Marquis, author of *Unconventional Warfare: Rebuilding U.S. Special Operations Forces*, who writes

Organizational values and culture cannot change quickly. They are the essence of the organization and must be changed over time, beginning with the most junior members of the organization. [Marquis 1997, p. 17]

and Millett, who notes that “[w]hen reformers found a way to institutionalize their new forms of warfare, they met with success. Messiahs are not enough; they need disciples.” [Millett 1996, p. 349]

Another aspect of institutional culture is what Williamson Murray describes as institutional rigidity. Institutional rigidity, according to Murray, reflects an institution’s “...inability and unwillingness to recognize not only that their opponent possessed alternative options and conceptions, but that he might exercise those options.” [Murray 1996b, p. 323] In other words, a military institution becomes unwilling to consider the actions of an enemy in terms other than the ones developed prior to actual conflict. Institutional rigidity can be “...enhanced by institutional biases against feedback that contradicted doctrine, conceptions, or preparations for war.” [Murray 1996b, p. 323] Murray contends that what makes rigidity dangerous is that it can lead to the dismissal of innovative ideas—ideas that might lead to more effective ways of carrying out military operations [Murray 1996b, p. 324].

An example of this institutional rigidity can be found in one of the writings of David Jablonsky. In a publication for the U.S. Army War College’s Strategic Studies Institute, Jablonsky wrote that

With or without the major test of war, innovation, as the complex relationship of doctrine and technology evolves, may not occur; and there is always the potential of facing a situation that J.F.C. Fuller described after the Great War [World War I]. ‘We had made up our minds to play whist,’ he wrote of 1914, ‘and when we sat down we found out that the game was poker.’ [Jablonsky 1994, p. 13]

Up until this point, institutional culture has only been discussed in terms of the negative impact it has on military innovation. It also exists as a force that exerts a positive influence on military innovation. If rigidity is a negative aspect of institutional culture, then institutional flexibility must be a positive one. Flexibility does not mean that every concept, no matter how ridiculous it might seem, ought to have resources committed to its development and eventual implementation. The fact of the matter is that not all new ideas

⁹ It should be noted that the relative significance of time changes in periods of conflict. Rosen wrote that “...in war, some officers die in battle, and others are promoted or relieved of command...on the basis of their performance in battle. This changes the pressures and incentives facing officers who must consider innovation and may alter the ways in which officers with new approaches to fighting rise to positions in which their views affect the behavior of the organization.” [Rosen 1991, p. 110]

are good ideas. Rather, institutional flexibility ought to imply a willingness to explore the concepts and technologies that appear to have promise in terms of increasing military capabilities in the context of the existing or anticipated strategic environment.¹⁰ This institutional flexibility allows for skepticism but does not let the skepticism impede efforts at conceptualizing and developing innovative ideas.

Institutional culture represents the traditional values, collective experience, and perceived identity of a service or subservice (i.e., branch). In dealing with military cultures it ought to be realized that part of the problem is its bureaucratic nature. Due to this, change must occur not only from above (i.e., senior officers), but from below (i.e., junior officers). Institutional culture can have both a positive and negative effect on military innovation. It has a negative effect when the military institution allows its culture to impede innovation because the innovative ideas do not conform to their perception of institutional tradition or the strategic environment. Conversely, if an institution is capable of considering innovative ideas free of the biases of tradition or a myopic perception of the strategic environment, then they should be capable of pursuing innovations more freely and with less resistance.

3.2.4. CIVILIAN PARTICIPATION

Civilian participation in the process of military innovation is another of the forces that influence military innovation. Civilian participation specifically entails three different components:

- The type of civilian participation,
- The amount of civilian participation, and
- The conditions under which civilian participation occurs.

These three components can have a potentially significant impact on military innovation. However, like the three preceding forces, the impact can be either positive, negative, or some combination of the two.

3.2.4.1. The Type of Civilian Participation

The first two components of civilian participation, type and amount, are closely related. In most cases, both components are clearly defined in the organizational basis for the government while in other cases the type of participation might be defined while the amount varies depending on the civilian leadership's assessment of the military. When we talk of type, we are essentially dealing with the role of the civilians. When we talk of amount, we are talking about the level at which the civilian government may intervene in military affairs.

¹⁰ Who, at the height of the Cold War, would have thought that the United States would investigate and commit resources to the military application of "sticky foam"?

If the type of civilian intervention deals with the role of the civilian in military innovation, we ought to first consider the role of the civilian in military affairs. Barry R. Posen, of the Massachusetts Institute of Technology, wrote that the role of the civilian is to

...audit...their military organizations to ensure that they stress the appropriate type of military operations, reconcile political ends with military means, and change with political circumstances and technological developments. [Posen 1984, p. 241]

Should civilians fail to participate in military affairs, Posen believes that the

...militaries will arrange a 'negotiated environment.' This is likely to take the form of either preserving a customary budgetary split or dividing shares equally....A tendency will emerge for each service to set requirements as if it were fighting the war alone. This can easily result in misallocation of the scarce security resources of the state. [Posen 1984, p. 54]

There is evidence among some civilian leaders that despite the reforms mandated by Goldwater-Nichols, the negotiated environment as described by Posen exists today. Consider the words of Senator Dan Coats in a recent speech about joint experimentation:

Within months the Defense Planning Guidance (DPG) will be published for the preparation of programs all the way out to 2005....Will this DPG accelerate some programs and terminate others to prioritize the development of future warfighting capabilities? I doubt it! Because....the Pentagon will default to its own bureaucratic processes which stifle change. Given this decisionmaking environment, Americans ought to wonder whether we are imprudently sustaining a Cold War defense establishment that is in part military anachronism and part domestic jobs program. [Coats 1997]

If we extrapolate this sense that there is a role for the civilian leadership in military affairs, then we can see that there is also a role for the civilian decision-maker in military innovation. Allan R. Millett views civilian interaction as a "critical ingredient" [Millett 1996, p. 359] of military innovation. He wrote

The history of interwar military innovation demonstrates the importance of civilian participation in the process of change at two levels, political and technological. Both levels of interaction are important. Not the least because they compensate for interservice and intraservice friction. [Millett 1996, p. 359]

Millett believed that military innovators need "...allies in the civilian political and technological establishments as well as patrons in their service." [Millett 1996, p. 359] Millett also noted that military reformers typically "...had to wait to reach senior positions and for a crisis to sway the debates to their favor" [Millett 1996, p. 361] since they typically "...shrank from finding political champions...." [Millett 1996, p. 361] In Millett's assessment of civilian role in military innovation, he seems to assert the civilian fulfills two

roles in military innovation: the first is the role of protector to military reformers and the second is that of the ultimate judge of competing concepts [Millett 1996, p. 368].

Stephen P. Rosen generally downplayed the role of the civilian leader in military innovation although he did note that "...they did help protect or accelerate innovations already in progress..." and that they "...may have played a somewhat larger role in wartime, creating new military capabilities that the military either had not thought of or resisted." [Posen 1984, p. 255]

Civilians can hinder military innovation in their role as protector and judge just as easily as they can contribute to their realization. The basis for this belief is that civilian leaders may not possess the education and experience to make strategically sound decisions. Concerning this difference in education and experiences between civilian and military leaders, Posen noted that "[t]he division of labor between civilians and soldiers is intense. Civilians are not likely to have the capability to dream up whole new doctrines." [Posen 1984, p. 57] Rosen offered additional insight into the problems of civilian-recommended reforms:

...the professional military may well regard an order to fight differently as being outside the legitimate authority of civilian leaders. Military professionals, not civilian politicians, are supposed to be the repository of expert knowledge on how to fight. [Rosen 1991, p. 11]

Despite the division between civil and military sensibilities, civilians can still participate in military innovation. Posen believes that

...civil intervention is dependent on finding sources of military knowledge. Civil intervention should take the form of choosing from the thin innovation menu thrown up by the services. In multiservice defense establishments, civilians have the possibility, depending on the strategic position of the state, of choosing among competing services. [Posen 1984, p. 57]¹¹

Civilian participation in military innovation can be both a positive and negative influence. The line between the two is very thin. The civilians can suggest innovative ideas but it is the job of the military to discern the viable concepts from the unrealistic ones.

¹¹ Consider the words of Senator Dan Coats: "I am not proposing we stifle inter-service competition. Rather, we should sponsor it....For example, the issue of whether airpower can be decisive in the containment phase of a war is so critical that it cannot be resolved through interservice bickering over the results of computer simulations. We need to...demonstrate whether or not this concept is viable because it determines where, when, and how the treasures of this nation are invested." [Coats 1997]

3.2.4.2. *The Amount of Civilian Participation*

If, as described above, the role of the civilian can vary, so can their actual amount of participation. As noted earlier, the amount of participation is meant to denote at what level in military affairs the civilian leadership may intervene to ensure their wishes are being adhered to. The amount of civilian participation is typically defined within the legal framework of the state although this may not always be the case. Consider the United States Congress.

The United States Congress, in addition to the having the power of the purse, is capable of intervening at any level of military affairs (see Figure 3.1). Besides the obvious ability of the Congress to fund (or not fund) military acquisition programs, their intervention can take the form of promoting or refusing to promote officers, confirming or rejecting political appointees, or mandating laws that directly affect the military. Each one of these actions directly affects the US military despite the fact that the effects of their influence can range from the imperceptible to the significant.

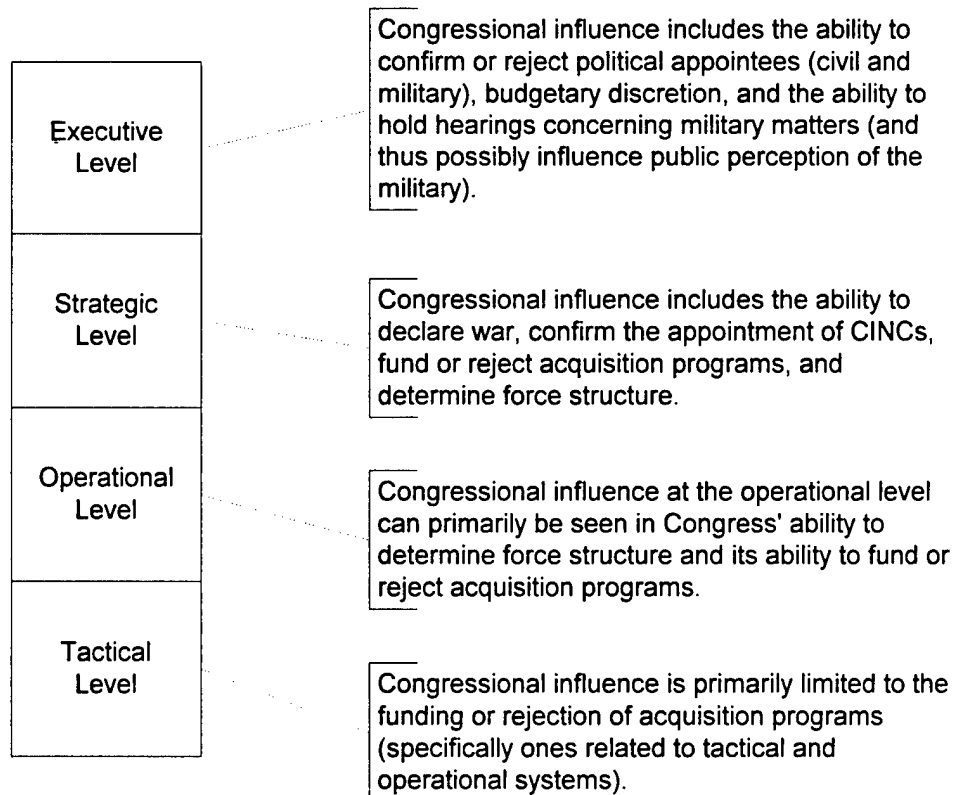


Figure 3.1. Congressional Influence on the Military

Now that it is understood that the type and the amount of civilian participation may vary from situation to situation, we ought to consider the circumstances under which civilian

participation occurs. Posen cites military defeat and unfavorable perception of the military as the conditions under which civilian participation in military affairs is most likely.

3.2.4.3. The Conditions Under Which Civilian Participation Occurs

The type and amount of civilian participation seems to vary depending on the conditions under which it occurs. There seem to be conditions that make civilian intervention in military affairs more likely: military defeat, civilian dissatisfaction with a particular aspect of military affairs, civilian dissatisfaction with a particular military institution, and times of significant geopolitical change.

Military defeat is often cited as a stimulus for military innovation. Barry R. Posen believes there are two reasons why this might be true. The first reason is that military defeat might "cause military organizations to reexamine their basic doctrinal preferences" while the second reason is that military defeat might cause "...soldiers [to] respond to the civilian intervention that defeat often precipitates in order to defend the organization's autonomy which is under attack." [Posen 1984, p. 57] Rosen notes that "...defeat in war is neither necessary nor sufficient to produce innovation." [Rosen 1991, p. 9] Rosen makes the preceding assertion because he believes that

Defeat by itself does not tell a military organization what future wars will look like, only that its preparations for the war just ended were not adequate. Defeat by itself does not insure that significantly new talent will rise to the top of the officer corps, since the postwar officer corps may well be composed of prewar junior officers trained in prewar methods. [Rosen 1991, p. 9]

The second and third conditions under which civilian participation in military affairs becomes more likely is when civilians are dissatisfied with a particular aspect of military affairs or a particular service. Under these conditions, civilians can foster change either through the legislation of the changes they desire to see made (e.g., the Congressional legislation requiring the development of U.S. Special Operations Command in the late 1980s) or through a reassignment of resources [Posen 1984, p.57]. The reassignment of resources not only provides the recipient service with an opportunity for developing new capabilities, but might serve as an impetus for the "loser" to initiate changes to win back their lost resources [Posen 1984, p. 57]. One of the benefits to be gained through this interservice competition is that policy-makers are provided with a selection of innovative concepts and technologies [Posen 1984, p. 57].

The fourth condition for civilian participation is a significant change in the strategic environment. The civilian leadership might choose to become involved in military affairs for one of several reasons: desire to reduce or reallocate defense spending, desire to develop a new response capability for a perceived threat that emerges as a result of the change in the strategic environment, or to compensate for a change in allies and adversaries. The U.S. Congress' mandate for a Quadrennial Defense Review and a National Defense Panel

following the collapse of the Soviet Union is an example of civilian participation as a response to a significant change in the strategic environment.

Civilian participation in military affairs can influence both the process and product of military innovation. The important aspects of civilian participation seem to be the type of civilian participation, the amount of civilian participation, and the conditions under which civilian participation occurs. The type of participation (i.e., the role of the civilian) can have either a positive or negative impact on military innovation since they may or may not correctly perceive the military needs of the state. The amount of civilian participation also influences military innovation. While the amount (i.e., at what level the participation occurs) also influences military innovation. The U.S. Congress, for example, can intervene in military affairs at nearly any level if it so chooses. Finally, the conditions under which the civilians participate impacts military innovation as that the conditions may affect the amount of participation/intervention that occurs.

3.2.5. ACCESS TO TECHNOLOGY

As stated earlier, technological innovations certainly have a role in military innovation. Therefore, access to technology becomes an important aspect of military innovation. Stephen Rosen felt that technological innovation represented a separate category of military innovations [Rosen 1991, p. 6]. Technological innovations are typically either enhancements made to existing technology through engineering or scientific breakthroughs, with the former being the more common of the two [Millett 1996, p. 343]. Millett felt that some questions concerning technological innovations lack engineering answers; it is not an the engineer who decides what systems to buy and how many are needed [Millett 1996, p. 344]. Interestingly, and perhaps most meaningful to those currently involved in technological innovations, Millett noted that

Where technology promises dual-use military and commercial applications, it tended to advance more rapidly than 'arsenal model' development...in which research and engineering remained the domain of military managers and technicians. [Millett 1996, p. 348]

That technology is a critical component of military innovation is indisputable. However, their importance should not be overstated. Timothy Garden, author of *The Technology Trap: Science and the Military*, wrote

In the West, the cornucopia of novel technologies has meant that we have increasingly sought a technical answer to every security concern. If we devote increasing resources to the expanding range of opportunities, we may find ourselves less and less able to afford to procure the weapons that we need for our security. This is the Technology Trap, and it has as its bait 'the neat solution'. [Garden 1989, p. 6]

Garden is not the only academic who feels this way. Williamson Murray noted,

Innovation is more than incorporation of equipment and technical change into doctrine, practices, and tactics. Innovation in tactics and operational concepts can prove as important on the battlefield as changes in equipment. [Murray 1996b, p. 306]

Allan R. Millett also felt that the importance of technological innovations should not be overstated. He wrote

Sheer technical innovation...does not win wars. Instead, the interaction of technical change and organization adaptation within a realistic strategic assessment determines whether good ideas turn into real military capabilities. [Millett 1996, p. 368]

Access to technology is an important component of military innovation. Some feel that technologies that can be carried over into the civilian sector can be developed more rapidly than the technologies with solely military applications. The importance of technological innovations should not, however, be overstated. Technology, like doctrine and systems, is simply a component of military innovation.

3.2.6. FINANCIAL RESOURCES

The availability of financial resources is yet another force that influences military innovation. While some believe that "...the development of future capabilities is limited by...fiscal resources available for defense" [Coats 1998, p. 15], a close reading of the literature on military innovation would indicate otherwise. Williamson Murray observed that

Western military institutions confront a future in which they will not receive anything similar to the funding and resources they received throughout the Cold War despite rapid technological change and innovation. Thus, they must innovate with less money and greater ambiguities about potential opponents and the nature of the wars they will have to fight. [Murray 1996b, p. 300]

Murray continued by writing that "Military institutions innovated during the 1920s and 1930s under circumstances similar to those that will influence military innovation in the next century..." [Murray 1996b, pp. 300-301]

Stephen P. Rosen also believes that military innovation can occur even in times of limited finances. He wrote

Bringing innovations to fruition will often be expensive. Aircraft carriers, fleets of helicopters, and ICBM forces were not cheap. But initiating an innovation and bringing it to the point where it provides a strategically useful option has been accomplished when money was tight. [Rosen 1991, p. 252]

So, while the availability of financial resources might influence the implementation of military innovations, it should not impede the military's development of innovative concepts and technologies.

Chapter 4. Military innovation as a Process

As noted in the standard definition, innovation is not only a product, but can also indicate a process. Each service of the U.S. military, as well as the Joint Community, has established a mechanism for conceptualizing and developing the innovative concepts and technologies they feel are needed for their continued military dominance. The scope of this paper is too narrow to examine each Service-based and Joint community-based mechanism individually, or assess the approach each uses to develop and implement innovative concepts and technologies. However, some historical examples can give insight into necessary components of the process.

4.1. THE GERMAN ARMY AND THE DEVELOPMENT OF ARMORED WARFARE

While history might not provide the decision-maker with all the answers necessary for answering the question, *What is the right way for the military to innovate?* it can provide the decision-maker with some insight into what has worked in the past. The German development of armored warfare following their defeat in the First World War is a good example of how we may look to the past for ideas that might be of use to us now and in the future.

Before we can discuss the actual development of armored warfare, we ought to consider the context in which it occurred. Tanks were introduced on the battlefields of World War I by the British in September of 1916 [Rosen 1991, p. 122]. The war ended in November, 1918, before the capabilities of armored warfare could be fully tested on the battlefield.¹² Despite the limited experience with tanks in the First World War, it was apparent that the tank would, in future conflicts, play a significant, although fairly undefined, role.

The German Army began its development of armored warfare under the leadership of Hans von Seeckt, chief of German General Staff from 1919-1920 and army commander from 1920-1926. In 1919 von Seeckt established fifty-seven committees to study various aspects of the First World War [Corum 1992, p. 37], including tank warfare [Corum 1992, p. 38]. Specifically, the committees were charged with writing short studies that considered the following questions:

¹² In 1918, the Germans had nine tank companies and used tanks in twelve battles, the largest of which was the battle at Villers-Bretonneux in which thirteen tanks were employed [Corum 1992, p. 122].

a). What new situations arose in the war that had not been considered before the war? b). How effective were our pre-war views in dealing with the above situations? c). What new guidelines have been developed from the use of new weaponry in the war? d). Which new problems put forward by the war have not yet found a solution? [Corum 1992, p. 37]

While the majority of these studies have been lost, the remaining ones show that the conclusions reached by these committees were put to practical use in the development of new doctrine [Corum 1992, p. 39].

In addition to an academic review of prior experiences and the formulation of “new” or revised doctrine, the German army set out to test their theories in the field. While the Treaty of Versailles forbade the German Army to possess tanks [Murray 1996a, p. 39], the German Army experimented with tanks through the use of simulated tanks in field exercises in Germany [Corum 1992, p. 133] and the use of actual tanks in exercises at the tank school in Kazan, Russia [Corum 1992, pp. 190-191]. The Germans evaluated the role of tanks in both “red” and “blue” situations [Corum 1992, p. 133]. It is worth noting that in addition to studying their own field experiences with tanks, the Germans studied other nations’ efforts at developing armored warfare doctrine [Corum 1992, pp. 131-132].

Even after the outbreak of hostilities, the Germans did not stop the development process. Following their victories in the Polish campaign, German leadership examined their operations and studied lessons-learned analyses in an effort to identify problems with doctrine [Murray 1996b, p. 314]. Once problems were identified, the Germans instituted training programs to correct problem areas and created feedback mechanisms to insure that training and exercises were conducted in accordance with the directives written to resolve the weaknesses demonstrated in the field [Murray 1996b, p. 314]. This willingness to be critical of even successful operations is part of what made the German Army such a formidable military force.

4.2. THE BRITISH NAVY AND ANTISUBMARINE WARFARE

The British efforts at developing antisubmarine capabilities in the Interwar period is a good example that can be used to contrast the method employed by the Germans in their development of an armored warfare doctrine. It is a good example because the British had ample experience with the problem of submarine warfare in the First World War and had in fact developed doctrine for limiting its effects (the use of naval escorts to protect convoys of ships). Between the two World Wars the British turned away from the proven doctrine in an effort to develop a new, more technological (and less passive) method to mitigate the effectiveness of submarines.

During the First World War, the German use of unrestricted submarine warfare was perceived to be a very real and serious threat to the British [Herwig 1996, p. 243]. The use of convoys to limit the effects of submarine warfare against merchant shipping was proven to be an effective tactic [Herwig, p. 241]. However, naval protection of these convoys was deemed “dull and monotonous” by naval professionals [Herwig 1996, p. 243-244].

Following the war, the British did in fact conduct an analysis of their experiences against submarines in World War I but "...the Admiralty classified the volumes and hence made them inaccessible to most officers." [Herwig 1996, p. 249] To make matters worse, the Admiralty, in 1939, "...declared [the volumes] obsolete and destroyed them." [Herwig 1996, p. 249] Those who objected to the passive role of naval escorts would frequently cite the low kill rate of patrol vessels without acknowledging the decrease in the amount of merchant shipping tonnage lost to enemy submarine attacks [Herwig 1996, p. 244].

The Royal Navy looked for a technological solution to the submarine problem and put its faith in asdic (an acronym for Anti-Submarine Detection Investigation Committee), the precursor to modern sonar. Senior Royal Navy officers viewed asdic as the technological innovation that would put an end to the threats posed by enemy submarines [Herwig 1996, pp. 245-246]. The grim reality of the situation was that asdic was largely ineffectual [Herwig 1996, pp. 246-247]. Experience showed that submarines were able to avoid detection by asdic nine times out of ten [Herwig 1996, p. 247]. Rather than attempt to correct the demonstrated weakness in the system, the Royal Navy attempted to keep asdic a secret from other navies by shielding asdic equipment from foreign visitors and locking asdic offices when not in use [Herwig 1996, p. 247]. One Admiral summed the whole situation up by saying, "The sad truth is that much of the navy disliked and feared submarines and was all too inclined to think that if they shut their eyes, the bogeyman would go away."¹³

4.3. CONCLUSIONS

These two historical examples offer some insight into the factors that make innovation, as a process, successful. Military innovation ought to start with a review of prior experiences in an effort to determine what needs to be accomplished. Barry Watts and Williamson Murray wrote that

A litmus test for any military institution confronted with the need for substantive peacetime innovation is a willingness to examine past military experience with something approaching the degree of objectivity, candor about shortcomings (or, even, outright failures), and openness to radical ideas that characterized the *Reichswehr* under Seeckt. [Watts and Murray 1996, p. 411]

While some might consider this review to be an effort to fight the last war better, Williamson Murray made a good point when he wrote

¹³ Admiral Sir Manley Power as quoted in Herwig's essay on submarine warfare [Herwig 1996, p. 247].

One of the most frequently quoted axioms of historians is that generals prepare for the last war and that is why military organizations have a difficult time in the next conflict. In fact, most armies do nothing of the kind, and because they have not distilled the lessons of the last war, they end up repeating most of the same mistakes [Murray 1996b, pp. 313-314].

Following a thorough and honest review, the military can set out to determine what innovations they would like to make. When the innovations have been made, the next step is a thorough and rigorous testing of the concept. This is the time to determine if the concept is flawed and how it might be repaired (or if it should be discarded). As important as it is to be committed to innovation, innovations ought to be assessed in an objective and honest manner. Failure to do so might some day result in the unnecessary loss of life or military defeat.

Chapter 5. Describing Innovation

While it is true that the "...order to innovate is likely to be ambiguous because what is being ordered...has never been done before" [Rosen 1991, pp. 10-11], decision makers can prescribe some general guidelines so that efforts at military innovation will be more likely to produce the innovations they desire. Likewise the decision-makers ought to acknowledge the fact that a military innovation does not have to be radical to have a profound influence on the conduct of military operations.

5.1. THE MAGNITUDE OF MILITARY INNOVATION

In the current debates about military innovation there seems to be a consensus that the military ought to be pursuing "leap-ahead capabilities" [Coats 1997], "innovative means" [Reimer 1998] as opposed to incremental improvements. The military's pursuit of some incremental innovations has caused some critics, from both within and without the Pentagon, to step forward and voice their dissatisfaction.

There seem to be two types of military innovation: evolutionary and revolutionary. Williamson Murray describes evolutionary innovations as a series of small but cumulative innovations that result in a significant change in military operations and capabilities [Murray 1996b, pp. 308-309] and revolutionary innovations as "...a phenomenon of top-down leadership—leadership that is well-informed about the technical as well as conceptual aspects of possible innovation." [Murray 1996b, p. 306] While I subscribe to Murray's definition of evolutionary innovation, I would describe revolutionary innovations as innovations that represent a significant departure from existing capabilities.

The U.S. military has pursued both types of military innovations. Evolutionary innovations can be seen in enhancement programs (modifying the M1A1 main battle tank to create the M1A2) and training programs (Military Operations in Urban Terrain). Revolutionary innovations, while certainly not as common as evolutionary innovations, also occur. Stealth technology, the development of nuclear submarines, and satellite technology are all examples of revolutionary technological innovations.

It is the military's pursuit of evolutionary innovations that seems to draw the most critics. Andrew Krepinevich, a member of the National Defense Panel (NDP),¹⁴ noted,

¹⁴ The National Defense Panel was a panel of experts established by Congress to assess, and offer alternatives to, the Department of Defense's *Quadrennial Defense Review*.

In a period of major geopolitical and military-technical change, the defense debate seems dominated by consideration over how best to wage the last war more efficiently, as opposed to preparing to meet new challenges both efficiently and effectively. [Peters 1997, p. 14]

and a Pentagon official was quoted anonymously as saying,

Do we need more carriers and faster, quieter subs now? Even if we could afford it...is it worth the cost? There's nobody out there who can touch us now. We have an opportunity to really explore new concepts and new technology and we find we can't afford to do it at the levels we should be doing it because we're buying all this other stuff. [Peters 1997, p. 14]

These criticisms represent the view of some who think the military is not pursuing enough revolutionary innovations. While it would be difficult to determine what percentage of the efforts at military innovation should be evolutionary and what percentage should be revolutionary, both types serve a purpose. Evolutionary innovations improve our existing military capabilities and revolutionary innovations change our military capabilities. Some evolutionary innovations are capable of producing truly revolutionary capabilities.

5.2. THE RELATIVE IMPACT OF MILITARY INNOVATION

There has been some criticism of the military's pursuit of evolutionary innovations; criticism that contends these incremental innovations will not provide the U.S. military with the leap-ahead capabilities need for military preeminence in the 21st century. It is difficult to know in advance if these critics are correct or not. However, in describing the magnitude of innovation (i.e., evolutionary or revolutionary), it seems as though magnitude is a relative assessment and ought to be considered as such. The impact of a given innovation ought to be considered within an appropriate context. The impact of military innovations can be, for convenience's sake, assessed at three different levels (tactical, operational, and strategic). Depending at which level the innovation is assessed, the impact of the innovation varies (see Figure 5.1). A revolutionary innovation at the tactical level might have little or no impact at the strategic level. Likewise, revolutionary innovations at the strategic level may go unnoticed at the tactical level.

When viewed in this manner, it becomes difficult to discern evolutionary innovations from revolutionary innovations in terms of how the particular innovation affects an institution. An innovation considered revolutionary and critical to the future survival of one service may be viewed as trite and unimportant by another. The job of the decision-maker then becomes one of assessing the relative importance of an innovation within the appropriate context and the overall strategic environment.

Evolutionary and *revolutionary*, when used as indicators of magnitude, ought to incorporate both the nature of a given innovation and its relative impact within a given context. While personal perception has previously been identified as a pitfall in the consideration and discussion of military innovations, it seems to be an unavoidable factor in

the assessment of military innovations. If decision-makers take the context of a given military innovation into account, they will see that often the line between *evolutionary* and *revolutionary* is not so well defined.

Military Innovation	Influence		
	Tactical	Operational	Strategic
Two Plane Stabilization in the main gun of main battle tanks	Evolutionary innovation (technology existed on ships) with revolutionary impact: the tactics, techniques, and procedures for armored warfare virtually had to be rewritten.		
Portable radio units for field use	Evolutionary innovation (communication has been an integral part of military operations since time immemorial) with revolutionary impact in that the tactical commander could communicate with their superior in real-time and the operational commander could acquire unprecedented command and control over their forces through real-time communication capabilities.		
The development of nuclear propulsion for naval vessels		While the evolution from conventional (or non-nuclear) to nuclear propulsion represents an evolutionary change, the implications of the change (especially in the context of submarines) could be considered revolutionary.	
Development of aircraft designed specifically for strategic lift capabilities			Evolutionary innovation (military aircraft existed since WWI) but revolutionary in the sense of ability of the U.S. to rapidly deploy forces globally.

Figure 5.1. Tactical, Operational, and Strategic Effects of Military Innovations

Chapter 6. Summary

The recent debates about military innovation seem to be complicated by the lack of (and failure to use) a standard definition. Innovation simply refers to either the "...act of introducing something new" [Houghton 1996, p. 931] or "[s]omething newly introduced." [Houghton 1996, p. 931] These simple definitions are often complicated by an association with other concepts such as *better* or *radical*. In fact, the whole debate about military innovation seems to be more about increasing military capabilities, a fact that makes earlier discussions about revolutions in military affairs (RMAs) appropriate for consideration.

Military innovation is a complicated topic as well. There is still a debate over its very nature: is military innovation natural or must it be stimulated by external forces? There seems to be good reason to believe that external forces directly influence military innovation. The forces with the greatest effect seem to be

- the existence of a coherent and well-developed grand strategy,
- a thorough assessment of the strategic environment,
- the institutional culture of the organization considering (or resisting) innovation,
- the type and amount of civilian participation and the conditions under which it occurs (e.g., military defeat or civilian dissatisfaction with a particular service), and
- the accessibility to or of availability of technological innovations.

The availability of financial resources does not seem to have the influence that many attribute to it.

Military innovation as a process seems to produce the best result when prior experiences are closely examined and critiqued, innovative concepts and technologies are tested in a thorough and rigorous manner, and the review of such concepts and technologies continues even after they have been implemented into the practiced doctrine of an institution. A failure to examine prior experiences or to thoroughly test innovative concepts can conceivably result in the commitment of resources to fundamentally flawed concepts and technologies. Perhaps even more important than the commitment of resources is the possible loss of life or military defeat that could occur in times of conflict as a result of inadequate pre-war testing.

In describing (or assessing) innovations, the difficulty seems to lie in maintaining a sense of perspective. There seems to be a tacit recognition of two types of innovation, evolutionary innovation and revolutionary innovation. Evolutionary innovations are

comprised of a series of incremental improvements that eventually produces a significant increase in military capabilities. Revolutionary innovations, on the other hand, represent innovations that suddenly and drastically increase or change the capabilities of a military institution. While there seems to be a common perception that revolutionary innovations are the more desirable of the two, any innovation ought to be considered within an appropriate context. Some evolutionary innovations have produced significant changes in how military operations are conducted and should not be dismissed as inferior to revolutionary innovations.

Military innovation will be an important topic so long as this, or any other, nation possesses a military force. Military innovation is not the problem of the military alone; it encompasses politicians, scientists, and academics as well as the military officers and enlisted personnel. In order for the U.S. military to innovate successfully, it must not only look to the future, but contemplate the past.

Appendix A. Annotated Bibliography

[Bacevich 1986]

The Pentomic Era

A.J. Bacevich

1986

National Defense University Press, 197 pp.

A.J. Bacevich's *The Pentomic Era* examines the U.S. Army and its attempts at divisional reorganization during the Eisenhower administration. This was a particularly difficult time for the U.S. Army as that President Dwight D. Eisenhower's "New Look" favored the U.S. Air Force and the Strategic Air Command.¹⁵ During this time period, the Army had several confrontations with the Administration in an effort to prove their relevance. Their argument was based on the fact that massive retaliation, as advocated in NSC 162/2, was a flawed and undeveloped strategy [Bacevich 1986, pp. 24-48]. Interaction between the Army and the Administration was made more difficult because of the animosity that existed between General Matthew B. Ridgway, U.S. Army Chief of Staff, and Secretary of Defense Charles E. Wilson [Bacevich 1986, p. 34].

In an effort to make itself more relevant to national security and improve its public image, the U.S. Army initiated several reforms ranging from the superficial (i.e., adopting a new uniform) to the profound (i.e., the adoption of the Pentomic division). The Pentomic Division represented the U.S. Army's effort to increase the survivability of the division on the nuclear battlefield through dispersing¹⁶ the various units of the division. In an effort to achieve their vision, Army leaders created a new unit, the battle group. Due to the presence of tactical nuclear weapons, which were believed to be capable of softening up enemy lines, frontal assault became the focus of offensive tactical doctrine [Bacevich 1986, pp. 108-109]. These forces were not designed for *heavy fighting* (which would be accomplished through the use of tactical nuclear weapons) as they were for *exploitation* [Bacevich 1986, p. 109]. Defensive doctrine focused on area defense, the creation of "small islands of resistance

¹⁵ In Fiscal Year 1953, the budget of the US Air Force was slightly less than that of the US Army. By Fiscal Year 1957, the budget of the US Air Force had swelled to the point that it was slightly less than the combined budgets of the US Army and Navy [Bacevich 1986, p. 16].

¹⁶ "Dispersion meant that units within a division necessarily would fight with greater autonomy than they would have in earlier wars. On the deep and fluid battlefield that Army theorists envisioned units would find themselves on their own—seldom tied in with friendly units on their flanks, unable to count on higher echelons to assist with either direction or materiel." [Bacevich 1986, p. 104]

widely separated over the most favorable terrain.”¹⁷ The defensive doctrine was the source of internal debate as officers attempted to determine whether such a defensive doctrine was inherently static or dynamic [Bacevich 1986, pp. 116-119].

The Pentomic Division turned out to be a failure. Bacevich cites several reasons why the new division was a failure [Bacevich 1986, p. 134]:

- Operational command of the Pentomic Division was “awkward and unwieldy.”
- The division commander was overburdened with command responsibilities.
- The Pentomic Division was poorly suited for conventional operations.
- The Pentomic Division proved to be incapable of sustaining itself during continuous operations.

In the years following the rejection of the Pentomic Division, several officers voiced their opposition to both the concepts that served as foundation for the Division as well as its envisioned structure [Bacevich 1986, pp. 134-135]. By the 1960s, the U.S. Army had once again refocused its attention on organizational and institutional reform.

The Pentomic Era offers the modern reader with some insight into military innovation, the importance of realistic and accurate testing and evaluation,¹⁸ and the importance of flexibility. While this book, like James S. Corum’s *The Roots of the Blitzkrieg: Hans von Seeckt and German Military Reform*, focuses exclusively on a single institution during a particular time period, it is a good read with some pertinent ideas.

[Corum 1992]

The Roots of the Blitzkrieg: Hans von Seeckt and German Military Reform

James S. Corum

1992

University Press of Kansas, 274 pp.

The Roots of the Blitzkrieg: Hans von Seeckt and German Military Reform is an excellent study of Germany’s efforts at military innovation and reform following their defeat in World War I. The German defeat in the first World War resulted in the Allies placing severe restrictions on the size and composition of future German armed forces. While these limitations were meant to prevent a German resurgence, the German military

¹⁷ General Willard G. Wyman as quoted by Bacevich [1986, p. 115].

¹⁸ Army tests with troops and actual atomic blasts (such as Desert Rock VI) that were meant to demonstrate the “compatibility” of nuclear weapons and ground forces were deemed to lack the realistic conditions that many felt were necessary [Bacevich 1986, pp. 112-114].

machine emerged as a preeminent military power in Europe less than two decades later. James S. Corum's book examines the early reforms that lead to future German military prowess.

Corum begins with a brief review of the military experiences gained by the combatants during the First World War. Corum then examines the pivotal role played by Hans von Seeckt, a German general who was chief of the General Staff (1919-1920) and commander of the Army (1920-1926), who was largely responsible for post-war military reforms in the German military. He also examines the internal doctrinal debates that existed in the German army, post-war German military training methods, Germany's development of (often proscribed) military technologies and related doctrine in the 1920s, and the Reichswehr as a "Mature Military Force" [p. 169]. The review of the experiences gained in the first World War provides the reader with a point of reference for understanding post-war concerns and conceptions.

This book is useful to those decision makers involved with military innovation not so much because it provides specific insights into the process of military innovation but rather it examines a remarkably successful case of military reform. The German army, as a whole, embraced an attitude that made introspection and innovation not only possible but prevalent. Certain chapters do offer some specific ideas that are directly relevant to aspects of the current effort at innovation but the book is better viewed as a whole. The only criticism of this book is that at times it examines innovations at a level of detail that may not have relevance to current decision makers.

[Garden 1989]

The Technology Trap

Timothy Garden

1989

Brassey's Defence Publishers, 148 pp.

The Technology Trap is a short but useful book about the role of technology in the modern military. While the book is somewhat dated ("...the potential adversary is the Soviet Union and its Warsaw Pact allies [Garden 1989, p. 4]"), it still offers some timeless truths about the military application of cutting-edge technology.

The author, Timothy Garden, begins by noting that "...progress in military scientific achievement offers an increasing range of more effective ways to wage war..." [Garden 1989, p. 1]. Garden also notes that due to the rapid pace of technological innovations and the inability of the military development and production cycle to keep a similar pace, "...new weapons become based on obsolete technology before they enter operational service [Garden 1989, p. 2]." Since it is financially prohibitive for most governments to thoroughly explore every single technological "avenue of interest," they must "...allocate priorities on the best assessment of the balance of risk against the financial and resource burden [Garden 1989, p. 2]."

To determine which technologies enhance military capabilities (and thus national security), Garden feels that a nation ought to conduct an analysis of

...the nature of the future threat, the prospects of technological progress in particular areas, national and global economic prospects, and a host of [other] unquantifiable social and political factors. [Garden 1989, pp. 3-4]

As was noted in Chapter 2 of this IDA paper, experts such as Williamson Murray and Allan R. Millett believe that a thorough assessment of the strategic environment is critical for successful military innovation.

Garden also offers a few words of warning to those who consider technological innovation. Garden noted that the "...greatest difficulty in a time of such scientific plenty is to preserve a sense of perspective. Today's miracle weapon is tomorrow's dead end." Garden also asserts that since wars rarely follow peacetime preconceptions, any peacetime assessment of innovative systems and technologies becomes difficult because, in times of war, "...equipment must be misemployed; and improvisation and initiative become more important than firepower and technical superiority." This inability to accurately envision future conflict leads Garden to believe that flexibility ought to be a key consideration in the design, development, and production of any new weapon system [Garden 1989, pp. 1-5].

[Marquis 1997]

Unconventional Warfare: Rebuilding U.S. Special Operations Forces

Susan L. Marquis

1997

Brookings Institution, 385 pp.

Susan L. Marquis' *Unconventional Warfare: Rebuilding U.S. Special Operations Forces* is an excellent book that examines the complex and often confrontational relationship that developed between the conventional military, special forces, and the U.S. Congress in the 1980s. While the content of the book focuses solely on U.S. special forces, it is useful to those interested in military innovation because it demonstrates the difficulties in overcoming institutional resistance—in this case, by the Services—and the key role civilians play in bringing about the changes that the military resists.

Marquis provides historical background on U.S. special operations forces in the latter part of this century. She focuses her work, however, on their marginalization following the Vietnam War, the inability of the U.S. military's special operations forces to rescue the hostages held in Iran (due largely to the fact that these forces were inadequately funded and improperly equipped), and the resurgence of special forces following congressional involvement in the mid- and late 1980s. After the Vietnam War, the Services refocused their concentration on the anticipated war with the Soviet Union—a conflict in which there would be little or no operational utility for unconventional forces. This perception among the majority of conventional military leaders resulted in the special forces being

marginalized. As a result of decreased funding, when the special forces were called upon to rescue the hostages held in Iran, the operation was a dismal failure. This failure sparked a desire among some within the government (particularly in the Department of Defense and on congressional staff) to revitalize the U.S. military's ability to carry out unconventional operations.

Heavy institutional resistance from within the military made the realization of this goal difficult. Marquis provides the reader with an excellent study of both the players and forces involved in this highly controversial struggle. This work helps the reader better understand the complexities of civil-military affairs and the implementation of meaningful reform.

[Murray and Millett 1996]

Military Innovation in the Interwar Period

Williamson Murray and Allan R. Millett, eds.

1996

Cambridge University Press, 428 pp.

Military Innovation in the Interwar Period is a collection of ten essays about peacetime military innovation. Seven of the essays examine specific military innovations (armored warfare, amphibious warfare, strategic bombing, close air support, naval aviation, submarine warfare, and radar) and the final three essays address the overarching concept of military innovation. Of the essays that examine specific military innovations, the editors asked the authors to "...structure their essays around three concepts: the strategic framework of the period, the organizational factors of the institution under study, and the doctrinal framework of the services [Murray and Millett 1996, p. 4]."

While it is difficult to categorize many of the examples cited as true innovations,¹⁹ each of the studies is useful because they are comparative studies. That is, they examine the development of a particular military doctrine or technology in several different and usually competing nations (the United States, Britain, France, Germany, and Japan—though not all of the nations are examined in any one essay). The authors also provide the reader with a brief historical background of the particular military innovation (the nation's military experiences with it during the First World War). Each study also provides the reader with a brief and usually concise study of a particular innovation.

Perhaps most useful to those involved in modern military innovation are the final three essays, two of which are summaries. Murray's essay on "Innovation: Past and Future" offers the reader several insightful thoughts [Murray 1996b]. Murray identifies what he feels to be the two types of military innovation, evolutionary and revolutionary (with

¹⁹ If we consider an innovation to be "[s]omething newly introduced [Houghton 1996, p. 931]." The military innovations cited in this collection of essays (with the exception of naval aviation and radar) were all introduced in the first World War. The Interwar Period allowed for further development of their technologies and their methods of employment.

evolutionary innovations being the more common of the two) [Murray 1996b, p. 306]. While these same terms are used in a slightly different manner in chapter 2 of this IDA paper, Murray offers his thoughts on each type. Evolutionary innovations

...take place over extended periods during which tactics, equipment, and conceptions change on a gradual basis...[T]he degree of innovation on a year-to-year basis is relatively small, but that cumulative, gradual change can lead to dramatically different results. [Murray 1996b, pp. 308-309]

Revolutionary innovations, on the other hand, are believed by Murray to be a phenomenon of “top-down leadership” [Murray 1996b, p. 306]. While this interpretation of *revolutionary* is contended by the author of this paper, Murray makes one assertion that holds true:

The lesson may be that if you are right, top-down leadership will allow you to get it very, very right. If you get it wrong, however, you will get it very, very wrong. [Murray 1996b, p. 308]

Murray’s summarizing essay is also useful in that he identifies some factors that have “...worked to further the path to success or failure in innovation [Murray 1996b, p. 311].” Specificity (“...the presence of specific military problems the solution of which offered significant advantages to furthering the achievement of national strategy” [Murray 1996b, p. 311]) and military culture (specifically the willingness of a military institution to examine historical experiences and learn from them) are, according to Murray, two factors that make successful military innovation possible. Two factors that impede military innovation are rigidity (an institutional unwillingness to “...recognize not only that their opponent possessed alternative options and conceptions, but that he might exercise those options [Murray 1996b, p. 323]) and the misuse of history (the “...wilful desire to discard history or to twist its lessons to justify current doctrine and beliefs. [Murray 1996b, p. 320]”).

Allan R. Millett, in his essay “Patterns of Military Innovation”, provides the reader with a summary much like that of Williamson Murray. Millett, however, identifies four factors that influenced interwar military innovation:

- strategic calculations (which encompass factors such as the anticipated enemy, the likelihood and location of future conflicts, etc. [Millett 1996, p. 336],
- the influence of technology,
- organizational politics (specifically, “...the political behavior of military organizations...” [Millett 1996, p. 336]), and
- “civil-military collaboration [Millett 1996, p. 359].

Rather than viewing these factors as forces for or forces against military innovation, Millett acknowledged that each of these factors could have either a positive or negative effect on military innovation.

The final essay, Watts and Murray's "Military Innovation in Peacetime", was meant to

...identify, based upon an examination of the historical record on innovation during the years 1918-1939, some of the specific actions, bureaucratic tactics, and strategies that senior current American defense officials today, whether military or civilian, might consider to facilitate and foster innovation in the years ahead.

[Watts and Murray 1996, p. 405]

Some of the aspects identified by the authors include the development of "visions of the future", an examination and acceptance of "operational realities", a bureaucratic acceptance of innovation, and the existence of an "...institutional process for exploring, testing, and refining conceptions of future war...", and, finally, luck [Watts and Murray 1996, pp. 406-410].

This book is useful to those involved in military innovation because it provides the reader with a series of short, readable essays that not only offer insights into military innovation, but provide historical examples in different national contexts. This collection of essays also happens to be one of the most recent works on peacetime military innovation.

[Rosen 1984]

The Sources of Military Doctrine

Barry R. Posen

1984

Cornell University Press, 283 pp.

Barry R. Posen's *The Sources of Military Doctrine* examines the development of military doctrine and the role it plays in national security policy. Posen uses Britain, France, and Germany between the two World Wars as case studies. Posen relied upon two theories: organization theory and the balance of power theory. Military doctrine is "...the subcomponent of grand strategy that deals explicitly with military means." As such, it must not only address what means shall be employed, but how they shall be employed [Posen 1984, pp. 7-13].

In his first chapter, Posen briefly examines several important aspects of military doctrine:

- the three military doctrines that a state (or military institution) may adopt: offensive, defensive, and deterrent [Posen 1984, pp. 14-15],
- the importance of doctrine, and the effects of doctrine [pp. 15-16],
- the strategic effects of doctrine [pp. 16-24],
- civil-military interaction and national security [pp. 24-29], and
- military innovation [pp. 29-33].

The remainder of the book expands on these concepts and later delves into the case studies using the three countries as examples.

Posen concluded his work with four “...general, policy-relevant conclusions” [Posen 1984, p. 241], three of which seem applicable in the current geopolitical environment:

- Military institutions will often act in ways “inimical” to the state unless civilian leaders act to ensure military doctrine is compatible with the security interests of the state [Posen 1984, p. 241],
- The political isolation of a state is dangerous because it will likely cause that state to take measures to ensure its national security (i.e., increase military capabilities, act in an unpredictable manner, etc.) [Posen 1984, p. 241], and
- Political and military alliances are valuable in maintaining regional stability [Posen 1984, p. 241].

While not dealing specifically with military innovation, Posen’s work is useful in that it provides the reader with some thoughts on the relation between national strategy and military doctrine and the various factors that contribute to the adoption of a specific military doctrine. While authors like Stephen P. Rosen refute aspects of this book, it is nonetheless representative of some serious thinking and analysis about military doctrine.

[Rosen 1991]

Winning the Next War: Innovation and the Modern Military

Stephen Peter Rosen

1991

Cornell University Press, 275 pp.

In *Winning the Next War: Innovation and the Modern Military*, Stephen P. Rosen examines twenty-one military innovations (categorized into peacetime innovations, wartime innovations and technological innovations) and provides the reader with some insight into why and how military institutions innovate. The book itself is divided into five sections: an introductory chapter in which military innovation, as an overarching concept, is considered, a section for each of the previously mentioned categories, and chapter which explains his conclusions.

The first chapter, “Thinking About Military Innovation,” is perhaps the most useful to those concerned with military innovation. In it, Rosen makes some observations that explain some of the difficulties inherent to military innovation. Some of these observations are:

- The main difficulty in military innovation is not so much that the *military* resists innovation, but rather *bureaucracies* resist innovation. Bureaucracies are not meant to innovate; they are meant to perform

“...routine, repetitive, orderly action [Rosen 1991, p. 2].” Expecting them to do otherwise (i.e., innovate) is asking them to do something they were not designed for.

- Military innovation typically lacks a clearly defined goal and is therefore difficult to accomplish. Rosen noted “[t]he order to innovate is likely to be ambiguous because what is being ordered is not some familiar, well-defined task but something that has never been done before. Those being ordered to innovate may well not have control over everything needed to carry out the order, particularly if what is needed is unconventional creativity [Rosen 1991, pp. 10-11].”
- Civil-military relationships and the politics of innovation are both decidedly complicated subjects that influence military innovation. Rosen feels that “...the professional military may well regard an order to fight differently as being outside the legitimate authority of civilian leaders [Rosen 1991, p. 11].” Likewise, military innovation requires services to undergo an institutional “ideological” struggle about the very nature of warfighting and victory [Rosen 1991, pp. 19-20].

Rosen’s book offers several equally valuable insights into military innovation.

In terms of case studies, Rosen limits himself to American and English military innovation although he does not limit himself to the interwar period (the period between the two World Wars). Some of the examples used are commonly cited ones (e.g., amphibious warfare, naval aviation) while others (e.g., guided missiles, helicopter airmobility) are unique to his book when compared to some of the other works mentioned in this bibliography. All in all, the book is fairly well balanced and has both relevance and use to those contemplating military innovation.

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13. ABSTRACT (Maximum 200 words) Military innovation has recently become an important topic in both civilian and military circles. This document, completed under IDA's Central Research Program, is meant to provide the reader with a basic understanding of some of the key issues pertaining to military innovation. The topic was researched through the collection and analysis of open source materials. Military innovation represents both a process and a product. The current debate seems to be characterized by miscommunication; miscommunication that stems from the participants use of intuitive (as opposed to universal) definitions. Military innovation, as a process, is influenced by several internal and external factors. Assessing the products of military innovation requires that the decision-maker not only consider the degree of change from current capabilities (evolutionary innovations versus revolutionary innovations), but the context in which the innovation occurs (i.e., the relative effect of the innovation).					
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